Electrical Equipment with Improper Wiring

Lawrence Berkeley National Laboratory Lessons Learned

LL-2001-03

Concern Statement: Equipment that is improperly wired or connected to underrated receptacle can operate for long periods without indicating any trouble, and then suddenly fail with serious consequences.

Applicable to: Operators of electrical equipment in laboratories and shops.

Incident

A plug and receptacle associated with a vacuum pump motor were melted and destroyed as a result of electrical wiring that did not conform to applicable electrical standards (i.e., National Electrical Code and National Electrical Manufacturer Association). The 1 horsepower motor was connected with a #16-gauge cord and a 15-amp rated receptacle, instead of the NEC required #12 gauge cord and 20-amp rated receptacle. Over time, this configuration caused overheating, damaging the receptacle and cord. The receptacle was protected by a ground fault circuit interrupter (GFCI), but GFCIs only protect against stray currents that cause electrical shock, and not over-current conditions.

Cause

A 120-volt, 1 horsepower motor is required by code to be connected with wiring rated at 20 amps. The vacuum pump assembly was not listed by a nationally recognized testing laboratory (NRTL), such as Underwriters Laboratories (UL), and as a result, the assembly did not meet applicable electrical standards. Due to the underrated wiring and improperly sized receptacle, the components slowly overheated and eventually melted down.

Recommended Actions

- All electrical equipment, and in particular electrical motors and pumps in laboratories and shops, should be checked for specifications on the equipment's electrical rating (i.e., voltage, horsepower, amps). Most equipment have tags, nameplates, labels, etc that provide such information. Whenever feasible, purchase equipment that have been tested by UL or NRTL as meeting minimum safety and electrical requirements. Wiring and receptacle specifications should match the equipment specifications. Standard LNBL receptacles are normally 15-amps or 20 amps. The 20 amps receptacles have a "T" shaped insert (see above).
- After the equipment has been connected to a power supply for a short period, check the cord for overheating. If the cord is unusually warm to the touch, disconnect immediately and contact the LBNL Electrical Safety Engineer.

Further Information

Any additional assistance or questions regarding this incident or the lessons learned may be directed to the LBNL Electrical Safety Engineer, Tom Caronna (x4314).

For other lessons learned, go to: http://www.lbl.gov/ehs/html/lessons_learned.htm

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